

JPRS-UAC-93-005  
2 June 1993



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# ***JPRS Report***

## **Central Eurasia**

***AVIATION & COSMONAUTICS***

***No 11, November 1992***

19971229 185

**DTIC QUALITY INSPECTED 2**

**DISTRIBUTION STATEMENT A**

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NATIONAL TECHNICAL INFORMATION SERVICE  
SPRINGFIELD, VA 22161

# Central Eurasia

## AVIATION AND COSMONAUTICS

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[The following are translations of selected articles in the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow. Refer to the table of contents for a listing of any articles not translated.]

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### **Yeltsin Edict Awarding Honorary Titles to Air Forces Officers**

93UM0420A Moscow AVIATSIYA I KOSMONAVTIKA  
in Russian No 11, Nov 92 (signed to press 2 Oct 92)  
p C2

[Text of Edict of Russian President Boris Yeltsin]

[Text]

**Edict of President of Russia B. Yeltsin of 16 Aug 92:  
"The Awarding of Honorary Titles of 'Honored Military  
Pilot of the Russian Federation' and 'Honored Military  
Navigator of the Russian Federation' to Pilots and  
Navigators of Armed Forces Aviation of the Russian  
Federation"**

Awarded to officers and generals of the Air Forces for particularly distinguished service in the assimilation of aviation hardware, high indicators of indoctrination and training of flight personnel and many years of accident-free operations in military aviation, the title of "Honored Military Pilot of the Russian Federation" to:

Major-General of Aviation Valdis Karlovich Alksnis,  
Major-General of Aviation Vladimir Dmitriyevich Grebennikov,  
Major-General of Aviation Genrikh Ivanovich Levkovich,  
Major-General of Aviation Ardalion Vladimirovich Pavlov,  
Colonel Yuri Petrovich Resnitskiy,  
Major-General of Aviation Vladimir Borisovich Sokolov,  
Lieutenant-General of Aviation Anatoliy Fedorovich Tarasenko, and the title of "Honored Military Navigator of the Russian Federation" to:  
Colonel Marat Yeskaliyevich Alaguzov,  
Colonel Nikolay Andreyevich Borisikhin,  
Colonel Viktor Aleksandrovich Korobetskiy.

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### **Continued Discussion of Artificial Intelligence to Aid Pilots**

93UM0420B Moscow AVIATSIYA I KOSMONAVTIKA  
in Russian No 11, Nov 92 (signed to press 2 Oct 92)  
pp 2-3

[Article by Candidate of Military Sciences Colonel (Reserve) V. Babich under the rubric "Combat Training: Experience, Problems, Opinions": "Artificial Intelligence at the Service of the Pilot"]

[Text]

#### **2. The Computer Comes To Help**

As has already been emphasized, all "stages"—the pilot, the commander, and the operator—are acutely in need of intellectual support "from outside": the control of a host of systems has led to the fact that they have been operating at the limits of their capabilities. It is no

accident that an increase in combat losses from erroneous decisions by those "stages," brought about first and foremost by an incorrect assessment of the situation and late reactions to changes in it, has been noted.

Aviation specialists who have encountered this problem have raised the necessity of creating "intelligent" electronic systems that could overcome the "creative crisis" of the individual in the execution of a combat flight.

The pilots in U.S. tactical aviation began the active mastery of terrain-following flights at ground level as early as during the war in Southeast Asia, in order to achieve high effectiveness in overcoming the opposition of North Vietnamese PVO [air defense] firepower. The fact that those flights are among the most difficult is confirmed by the figures for the accident rate in the American Air Force over the period from 1966 through 1976: out of the overall number of crashes and accidents, 47.2 percent occurred through the fault of the flight personnel, of which 11 percent were a consequence of aircraft collisions with the ground. This alarming signal was the basis for adopting various technical innovations that eased flying at very low altitudes—the pilot, along with the cockpit, were "lifted up" above the fuselage somewhat for a better view of the airspace and visual monitoring of the altitude; a scrolling electronic map with a blip showing the true position of the aircraft appeared as part of the cockpit equipment; the readings of many of the flight instruments and aiming data were brought up onto the windshield.

This program, however, did not have positive results. This quite unexpected outcome was explained by the fact that, first of all, the projected unburdening of the pilot when performing the "rough" work in the cockpit was "compensated for" by the increased complication and expansion of the set of equipment on third-generation combat aircraft and, second, the time periods for developing effective means of overcoming new types of PVO systems were constantly trailing the requirements of the times, while the number of new types of PVO was increasing significantly. A search for new tactics, in other words, was under way primarily in the air and without the careful development of the fundamentals on the ground, which led in turn to an increase in the number of erroneous decisions made by the "stages."

Insofar as the enemy short- and medium-range air-defense systems had become quite mobile, for example, the crews of the strike aircraft often proved to be in a difficult position due to the lack of up-to-the-minute information on their actual locations by the time of the sortie. The pilots were thus most often in a state of "uncertainty" in the stage of overcoming PVO defenses. The lack of such essential initial data on the enemy sharply reduced the quality of their assessment of the situation and led to the selection of far from the best operational variants; the enemy fire in most cases caught the bomber when the crew least expected it. The intrinsic informational capabilities of the airborne strike system were limited, which brought onto the agenda the

problem of combining reconnaissance in depth of the airspace with the execution of a strike.

The efforts of the American creators of electronic hardware have now had their first positive results—they have reported the successful testing of a new computer system during Desert Storm intended to assist the pilot in overcoming Iraqi air defenses.

The "electronic consultant" was developed under a program with the complicated name of "Improved Much on Much" (IMOM). The desires of the flight personnel, who had displayed a preference for tactics that made it possible to avoid direct confrontation with enemy interceptors and air-defense systems entirely, were taken into account therein.

The "consultant," as with any other electronic system, consists of several units for information processing with a host of "inputs" and "outputs." The geographical data on the area of combat operations, superimposed with the zones of PVO acquisition, tracking and lethal zones, is entered into the "planning" unit before the sortie. The map is prepared using special gear and with the utilization of constantly incoming intelligence data.

In the course of battle the computer analyzes the information entered into it and "offers" its decisions to the crew. During the first stage of the flight to the target it issues an overall map of the solid zone of detection of the enemy radar, and any "blind spots" that have been ascertained in it, to the tactical situation indicator (ITO) installed in the aircraft cockpit. That information makes it possible for the crew to select the optimal routing and flight profile to ensure a low probability of aircraft "illumination." An analysis is then made and efficient antimissile maneuvers are "recommended" with a regard for the determination of the zones of possible tracking of airborne targets by the SAM system radar stations. The computer "seeks out" effective means of evading PVO fire when it is not possible to avoid entering its lethal zone. This computerized process fully imitates the substance of the usual (not encompassed by automation) bomber crew preparation for a sortie on the ground, but with one marked difference—all of the necessary calculations are performed much faster and more precisely.

The "consultant," however, is not "limited" just to improving already developed techniques of planning a combat flight, but also organically supplements it with new elements. First, it can determine the effect of the radar signature of the aircraft on the capabilities of the enemy radar to detect airborne targets. The ITO of an F-117A, for example, shows their scan zone narrowed (compared to, say, an F-15), as a consequence of which the pilot obtains greater freedom in his choice of routing (the "safe" flight trajectory is shown on the screen by color-coded arrows).

Second, taking into account the fact that the crew use of individual EW gear in many cases exposes the strike aircraft, the computer "offers" a choice of stretches on a

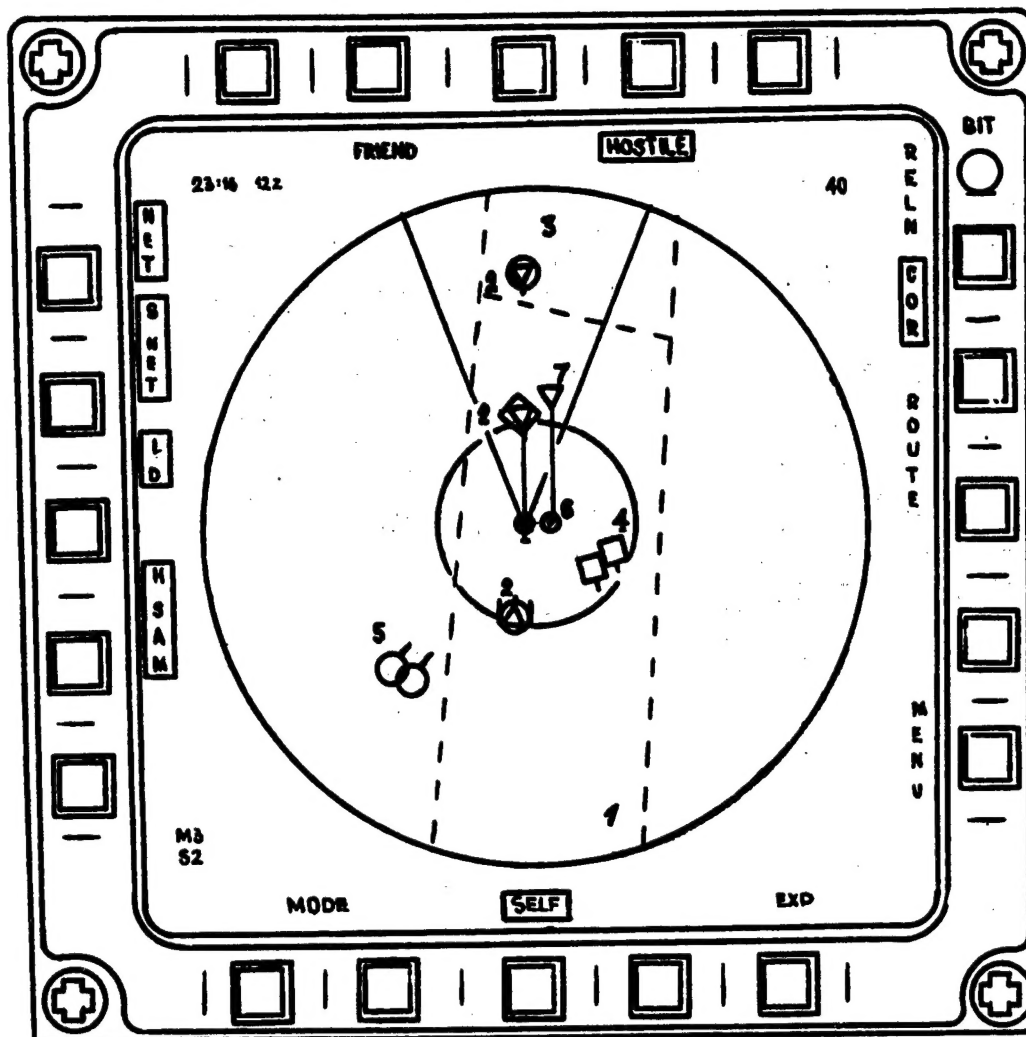
flight path on which the use of on-board jamming transmitters is not highly necessary after an analysis of the enemy radar field. It also determines, at the same time, the expediency of activating a special EW aircraft, either from a zone located above its own territory or from the overall battle formation. If the variant chosen to "neutralize" the PVO proves not to be effective enough to achieve the assigned parameters for the survivability of the strike groups, the computer "recommends" the allocation of aircraft equipped with anti-radar missiles to break through the PVO.

The situation as depicted on the ITO screen is constantly altered in the course of the flight to the extent that new data comes in from the JTIDS combined tactical information system; the computer recalculates the trajectory of the aircraft to the target, expands it or, on the contrary, narrows the zone of detection and the lethal fire zone of enemy PVO and "shifts" the jamming sectors.... But the pilot may in turn make corrections at any time to the "plan" solution in the event an unforeseen situation arises in the air.

Predicting the actions of enemy fighter aviation poses a certain difficulty. The computer calculates in advance the assumed lines of engagement and entry into battle of the interceptors and their possible quantities with a regard for the locations of their base airfields. That information helps in determining the minimum detail of one's own fighters for escort and their place in the overall battle formation.

The person, however, always has the last word in the dialogue with the ultramodern computer, no matter what memory the computer has or how fast it operates. This pertains especially to the development of the battle plan and the distribution of manpower and equipment—of which the aviation commander most often has an acute shortage—for the performance of the mission. He has to compensate for that with the more artful waging of battle and, in particular, the competent disposition of forces in the principal stages of the flight.

The overall battle formation, in accordance with experience in the execution of the Desert Storm operation, as a rule includes bombers (or fighter/bombers), jamming aircraft, PVO penetration aircraft and escort (screening) fighters. They all moreover perform only their immediate functions within the framework of the unified plan for the combat mission, maintaining fire and tactical interaction achieved as a result of the "conversation" of the group commander with the computer; the pilot "superimposes" the plan for the performance of the mission onto the information existing in the computer memory on the state of the enemy PVO groups. According to the rules of the dialogue, it issues to him its own variation for the plan of operations in the form of graphical images on the ITO screen. Then comes the "next move" by the commander—"cancel," "correct," "confirm" and, finally, "approve."



Depiction of aerial tactical situation on display screen of JTIDS system designed for the F-15 aircraft (variation):

Key:

1. corridor for passage of one's own aircraft
2. enemy targets being tracked
3. zone of possible launch of guided missiles
4. unidentified targets
5. one's own aircraft
6. wingman, who has received command to track target (7)

This plan becomes the guide for operations only after the computer has carefully compared it with several proposed variations and deemed it the optimal one, that is, the one that corresponds to the prevailing situation. And the more precisely the course of the impending operations has been predicted, the less the likelihood of a crew in the air getting into a state of "uncertainty" and making erroneous decisions. The plan for the whole flight is realized more fully as a result.

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**Maintenance, Restoration of Airfield Operational Capability**

93UM0420C Moscow AVIATSIYA I KOSMONAVTIKA  
in Russian No 11, Nov 92 (signed to press 2 Oct 92)  
pp 4-6

[Article by Candidate of Military Sciences Colonel N. Tsupko under the rubric "For High Combat Readiness": "Maintaining the Operational Capability of an Airfield"]

[Text] The disabling of enemy airfields in the initial period of a war is one of the principal conditions for winning air supremacy. This was also confirmed by the experience of combat operations in the Persian Gulf, where many of the airfields of the Iraqi Air Forces were destroyed in the very first offensive air operation (VNO).

Aviation is becoming the principal means of disabling airfields in the European theater owing to the elimination of medium- and short-range missiles. In the event a military conflict is unleashed, it will inflict mass and concentrated strikes for the purpose of destroying runways and taxiways, damaging fortified structures, disabling aircraft, command-and-control stations and personnel support equipment and destroying stores of ordnance and fuels, as well as impeding restoration operations on the damaged facilities.

Concrete-piercing aerial bombs (BetAB) and cluster ordnance with submunitions can be the principal aviation weapon for operations against airfields. The destructive area of one 750—1,000-pound BetAB could reach 150-200 m<sup>2</sup>. The dimensions of the crater on the runway are 12-14 meters in diameter and 3.0-3.5 meters in depth. Cluster munitions filled with 30 small-caliber BetABs and 215 antitransport mines will have craters with considerably less depth (0.8 meters), but the area of damage to the runways could reach 375 m<sup>2</sup> or more. The scattering of delayed-action mines with various actuation times will moreover significantly impede the restoration of airfield functions. Repeated raids (every four to six hours) on airfields by small strike groups (up to four to eight aircraft) will also make it more difficult.

Damage with a total area of 1,500 m<sup>2</sup>, according to foreign data, will suffice to disable a runway of 2,400 x 60 meters. That is achieved by dropping seven or eight type-25E Durantale BetABs or four or five JP233-type cluster munitions on the runway.

If one takes into account that the combat load of aircraft in tactical aviation is four units of the enumerated aviation ordnance, the destruction of the runways at an airfield requires no more than two aircraft. An average of up to 16 tactical fighters, however, were allocated from the multinational forces (MNF) to perform that task for each Iraqi Air Forces airfield during the combat operations in the Persian Gulf. Calculations show that this quantity of aircraft makes it possible, with a PVO [air defenses] penetration factor  $K_{PVO} = 0.6-0.8$  and a destructive factor of  $K_{DES} = 0.7-0.9$ , to lay 930-960 antitransport mines and destroy 4,320—5,440 m<sup>2</sup> of runway and taxiway surface (540-680 PAG-14 slabs).

Analysis of statistical data and the production capabilities of support subunits provides grounds to assume that the repair operations alone could take from seven to 12 hours to 1.2-1.5 days for an airfield-engineering battalion, and from two to six days for an airfield-maintenance company.

If repeat raids are made against an airfield, then it could remain unrepaired by the start of the second VNO (in three to five days) with even minimal destruction.

The blockading of aviation at an airfield can be achieved by more than its destruction alone; its seizure by airborne assault or the operations of commando groups, for the purpose of disabling the airfield or holding it until the approach of ground troops, is also possible.

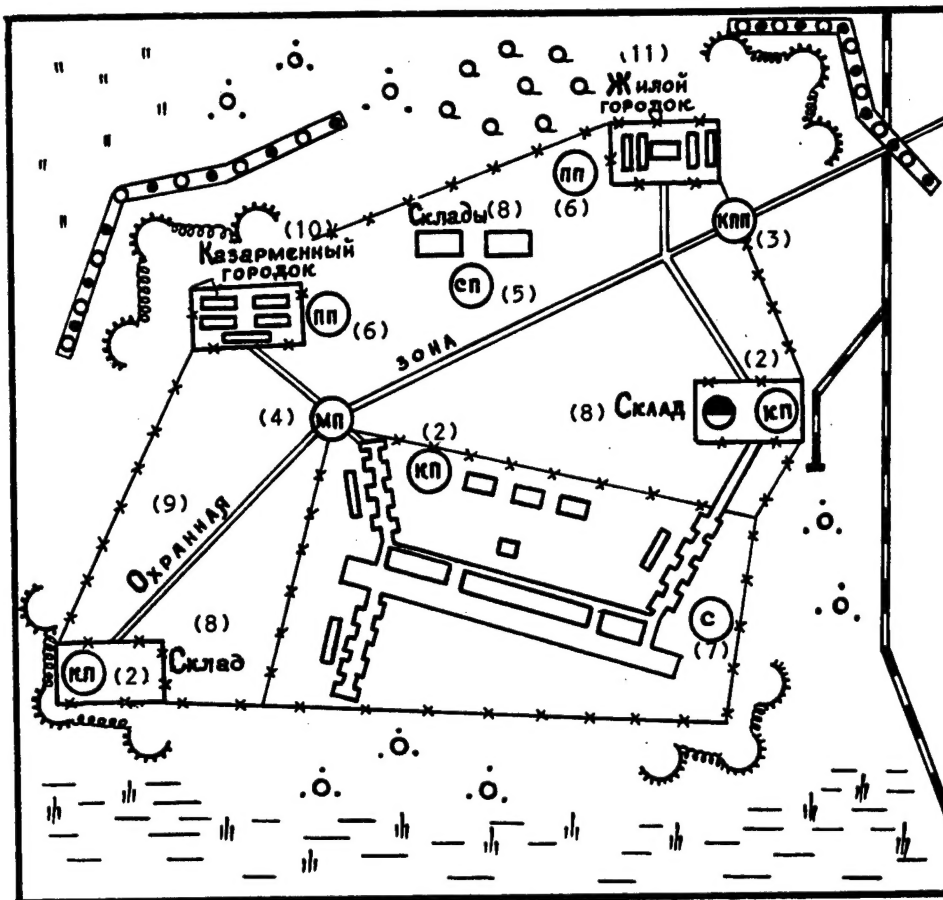
How can maintenance of the operational capability of the airfield be ensured? This problem can be solved in two basic directions—by preserving its constant operational readiness, and by providing for its rapid restoration with any damage.

The uninterrupted functioning of the airfield is achieved by means of carrying out a whole set of measures both for advance (in peacetime) and direct preparation for waging combat operations. Chief among these are the upgrading of the operating airfield for the purpose of increasing the area suitable for the takeoff, landing and taxiing of aircraft and raising the effectiveness of its tactical camouflage, the engineer preparation of the terrain in the interests of the ground defense of the airfield and the regular maintenance and routine repair of runway hard surfaces.

In modernizing airfields, it is desirable to provide for lengthening the operating hard-surfaced runway, constructing a second hard-surfaced runway, expanding (to 18 meters) the main taxiway, constructing group hardstands and protective structures for aircraft, increasing the storage capacity for fuels and preparing and berming sites for the open storage of aviation ordnance, among others. The performance of these operations makes it possible to more than double the operational capability of the airfield. The increased cost of upgrading the airfield with changes in its dimensions, however, is proportionate to the increase in the linear dimensions of the airfield cubed.

The organization of protection and ground defense of the airfield merits particular attention. We are all witnesses to the fact of how much the threat of disruptions in the normal operations of many military facilities, and even attacks on them for the purpose of seizing weapons and military hardware, has risen with the increased tension of the climate in the Russian Federation and in some of the independent states. An airfield is no exception, and is an even more likely target of attack with the start of combat operations.

A protected zone should be defined and surrounded with barbed wire in order to guard the airfield, and it should include the flight field, the dispersion zone, service and technical structures, stores, barracks and residential compounds. The protection is organized by guard details, sentry posts, traffic checkpoints, motorized and foot patrols, the deployment of patrols and surveillance posts and the use of automated signal systems (see figure). Concealed obstacles and signal minefields can also be installed where necessary.



(1) УСЛОВНЫЕ ОБОЗНАЧЕНИЯ:

- |   |                            |
|---|----------------------------|
| (2) (кп) — караульное помещение         | (5) (сп) — сторожевой пост |
| (3) (кпп) — контрольно-пропускной пункт | (6) (пп) — пеший патруль   |
| (4) (мп) — моторизованный патруль       | (7) (с) — секрет           |

Key:

1. Symbols:
2. guard detail
3. checkpoint
4. motorized patrol
5. sentry post
6. foot patrol
7. surveillance post
8. stores
9. protected zone
10. barracks compound
11. residential compound

The preparation of strongpoints and detached firing positions using prefabricated reinforced-concrete structures is advisable in order to increase the reliability of ground defense of an airfield during immediate preparations for combat operations. Antitank, antitransport, and antipersonnel mines are emplaced on the open approaches to an airfield.

The experience of combat operations in Afghanistan and calculations have established that the engineer preparation of an airfield in the interests of its guarding and ground protection requires 10-12 units of prefabricated structural elements for reinforced-concrete structures, 30-35 tonnes of barbed wire and stringing wire, 20-25 m<sup>3</sup> of crushed stone, 70-80 tonnes of cement, 40-50 sets of concealed obstacles and up to 2,000-3,000 signal, anti-personnel, antitransport, and antitank mines.

The combat operations in the Persian Gulf testified to the fact that the effectiveness of camouflage measures could be raised by increasing the number of false targets and making widespread use of decoys and camouflage. Two or three false positions were organized for every actual one in the Iraqi Army, for example, thanks to which the effectiveness of the use of high-precision weaponry (VTO) by the MNF was reduced. The lack of a sufficient quantity of decoys in the Iraqi armed forces nonetheless led to significant losses at actual positions.

One may assume that the set-up of one false airfield for every operating one will cut the likelihood of its detection in half. Calculations have shown that the set-up and simulation of activity at such an airfield (or helicopter pad) requires mock-ups and decoys in the quantities indicated in the table.

Means of decoy and camouflage	Requirement for equipment and decoys, each	
	airfield	helicopter pad
Aircraft and helicopters	16-20	5-7
Airfield technical support and electronics	up to 20	5-6
Sites for open storage of stacks of ordnance	8-10	3-5
Fuel tanks	10-12	5-6
Start and lighting equipment	one set	
Corner reflectors	up to 500	200-250
Camouflage sets	15-20	10-15
Heavy tents	10-15	4-6

An analysis of the data presented makes it possible to conclude that the requirement for decoys and means of camouflage can be satisfied only with the availability of an industrial base for their manufacture.

Since a permanent airfield is a fixed target whose coordinates are known to an enemy before the start of combat operations, the false target is most expediently set up in its immediate proximity, with the operating field carefully camouflaged. The airfield in the area of Baghdad was thus altered in appearance to that of a residential complex with multistory buildings, which were not perceived by the enemy as a military target and were thus not subjected to air strikes.

Radio-absorbing and radio-dissipating coatings can be employed successfully for the camouflage of an operating airfield. The likelihood of detection of a target camouflaged in that manner can be reduced by three to four times. It has been established that the use of aerosols reduces the effectiveness of target strikes by 10 times.

The use of decoys and camouflage requires the training of the personnel, and it is thus advisable to have a special subunit for this purpose at an aviation technical base in wartime.

The constant readiness of an airfield is also determined by its operational upkeep and routine repairs. I would

like to recall in this regard the undeservedly forgotten and exceedingly effective methods of preventing icing on hard surfaces.

Sharp fluctuations in air temperature with high relative humidity have been observed over the last decade in the European part of Russia during the winter. Such conditions are the most favorable for the formation of ground-surface icing. The use of chemical reagents to fight it is not recommended from an ecological standpoint. The thermal method is too expensive under conditions of an energy crisis (800-1,000 kg of fuel per 0.5 ha [hectare] of hard surface of the airfield, about 1/20th of the hard-surfaced runway).

It is more advisable to prevent surface icing than to fight it, the more so as the weather service of an aviation unit can predict an icing situation almost without error. During thaws or rain with a forecast of a drop in temperatures to negative values, the runways and taxiways must have snow thrown onto them using a rotary snowblower with a lateral safety strip. Dry snow should not be removed from the runway until it stops coming down when there is a snow cover under conditions of negative temperatures and a forecast of the onset of warming with the fall of wet precipitation. The formation of a thin film of ice on the concrete surface with the freezing of drops of rain or drizzle will be averted in both

cases. Wet snow should be removed immediately upon the end of the fall of ice-forming precipitation.

The operational capability of an airfield is largely dependent on the opportunities for the airfield engineering and aviation technical units to restore the runways in a short period of time or to provide for the takeoff and landing of aircraft on damaged (shortened) runways. That can be achieved thanks to the performance of both organizational and technical measures.

Organizational measures include the reconfiguration of the airfield engineering unit from the construction of field airfields to the construction and repair of airfields with hard-surfaced runways. A detached aviation engineering battalion could consist of several air-mobile engineer and construction subunits of a modular type. Every third subunit should allocate three or four repair and restoration teams (RVK) that are able to provide for fixing damage with an area of 150-200 m<sup>2</sup> over a time less than that between repeat strikes against an airfield (three to four hours). One mandatory condition for this should be the availability of a reserve of repair and construction materials stored at the airfield, in amounts that would provide for the performance of repair operations on an area of no less than 1,500 m<sup>2</sup>.

The principal technical measures could be the development of various sets of equipment for the repair of runways and methods of fixing craters with their aid. According to information in the foreign press, American specialists have proposed and tested an air-mobile kit for the rapid repair of airfields. It includes plastic mesh for stabilizing soil and mats manufactured of fiberglass, impregnated with polyurethane, to cover the filled craters. A team of 13 people with the necessary engineering equipment is able to fill a crater of 7.5 meters in diameter on a runway in three hours using it.

The use of planking made of metallic mats is most expedient for covering craters here, insofar as we do not have such polymer kits. Their dimensions should exceed the diameter of the damage by no less than one meter.

The use of mobile airfield braking installations is expected in the Japanese Air Force in order to support the landing of aircraft on damaged or shortened runways. They operate according to the principle of an arresting device on an aircraft carrier. Such experience could also be used at our airfields.

Additional spending is required, of course, in order to carry out the measures raising the operational capability of airfields. But it provides for the possibility of the successful waging of combat operations during the initial period of a war, and completely recoups all of the expenditures that are made during peacetime.

**From the editors.** *The views of the author on the problem being researched and his calculations, made with a regard for domestic and foreign experience in improving the airfield network and combat operations in Afghanistan and the Persian Gulf, as well as the recommendations he*

*has devised, are not incontrovertible. Additional research and verification in practice are essential. We hope that the article will be of interest to the commanders of aviation and aviation-technical units and other officers responsible for ensuring the operational capability of an airfield. We await your responses.*

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### Importance, Ways of Maintaining Personnel Physiological Reserves

93UM0420D Moscow AVIATSIYA I KOSMONAVTIKA  
in Russian No 11, Nov 92 (signed to press 2 Oct 92) p 7

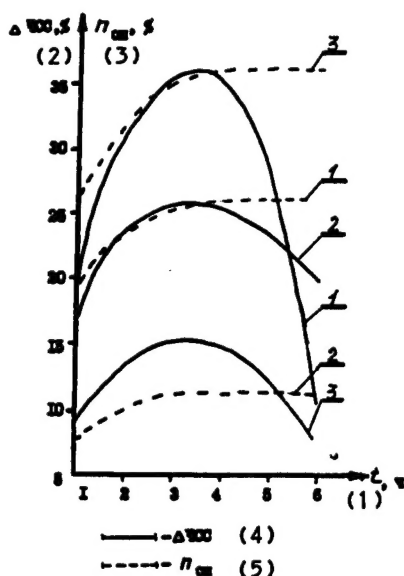
[Article by Doctor of Medical Sciences, Colonel of the Medical Service P. Shalimov under the rubric "Flight Safety—Advice of a Specialist": "The Capabilities of the Organism: Are They Unlimited?"]

[Text] *What a tumultuous day he had had! And he was so tired, but now here were some more concerns... Captain V. Zazykin sighed heavily and recalled that he had consented to an extra duty shift at the control tower. How many of them had there been this year already? Many, very many. He was tired, and his leave was a long way off. Supervision of the airfield traffic zone is a crucial task. He is a high proficiency-rated specialist. They trust him. That means he must!*

But must he? What is the effectiveness of work "at the limits" of capabilities? How is that state reflected in the health and professional reliability of a specialist on the flight operations team (GRP)? The answers to these questions have been provided by research, establishing that a slow and chronic expenditure of psychological reserves and inexorable fluctuations in the level of professional reliability ( $n_{osh}$ ) are observed in the dynamic of the periods between leaves for GRP specialists in annual cycles.

The rate of decline in reserves of the body depends substantially on the regimen of work and rest and the yearly professional demands. When they are low—under 30 flight shifts—the level of reactions (increase in the frequency of heart contractions  $\Delta FHC$ ) is the highest, but it is not stable and is quickly exhausted over the course of a shift (1), which is explained by the unsteadiness of professional skills. With moderate yearly demands—from 30 to 70 flight shifts—a high and steady level of physiological reactions is observed over the whole flight shift (2), which testifies to the high psychophysiological reserves of the body. At high yearly demands—from 70 to 100 flight shifts—the level of reactions in the process of flight supervision is low (3), and the reserves of the body are quickly depleted.

Three levels of reactions of physiological systems were ascertained in accordance with these gradations of the yearly work demands. Additional demands or the effects of unfavorable factors deplete the body's reserves to an even greater extent. Research has established that the



## Key:

1.  $t$ , hours
2.  $\Delta FHC$ , percent
3.  $n_{osh}$ , percent
4.  $\Delta FHC$
5.  $n_{osh}$

lack of conformity of work demands to psycho-physiological capabilities can lead to a reduction in the body's reserves of 70-80 percent of their initial values over the yearly activity cycle. This condition may not be manifested outwardly or clinically. It is ascertained only with continuous recording (monitoring) of physiological reactions that are registered immediately in the process of professional activity.

Interest is growing around the world in studying the condition that is intermediate between health and sickness. Scientists have defined it as a "third state"—normal, but characterized by reduced reserves of the body and insufficient adaptability to the effects of unfavorable factors. It is manifested more in somewhat of a worsening of overall well-being, the spheres of will and motivation and ability to work rather than in morbidity. That is even though, in the opinion of some scientists, it is namely this state that is the source of many illnesses. The fact that the effectiveness and reliability of the labor of people whose body is in the "third state" is markedly reduced is also important. The lowest level of errors in work is observed in the process of flight shifts among GRP specialists who have high psycho-physiological reserves. The lowest professional reliability is revealed accordingly among specialists with a low level of reserve capabilities.

The level of body reserves among GRP specialists thus acts as an important factor of professional reliability and

effectiveness of activity. Work to preserve the reserves of the body are thus one way of ensuring combat readiness.

The range of means of maintaining body reserves at a high level is quite broad. It includes both nonspecific and special means and methods. One of the simplest and most effective is a rational regimen of work and rest and the setting of standards for professional demands. The body's reserves are very dynamic and, with optimal functional demands, possess a strong ability to restore themselves. If the rest following a flight shift is in full accordance with requirements and corresponds to the preceding demands in duration, reserves are quickly and fully restored. This process is accelerated by proper sleep, massage, sauna, water treatments and the like. The employment of measures for the accelerated restoration of body reserves—occasional 10-15 minute breaks, especially at the beginning and end of the shift, psychological relief, the prevention of stress and tension etc.—has an even greater impact during the flight shift itself.

The level of professional skills has a substantial effect on the body's reserves. Their preservation requires the active utilization of preflight drills, various simulations and special simulators. Modeling and simulation systems have been created using personal computers that make it possible to simulate any possible situation. Research has established that they are most effective in the preservation of skills and the training of GRP specialists at the optimal and low levels of yearly professional demands. A steady level of functional reserves and professional reliability is preserved for no less than nine months.

The impact is insignificant and lesser in duration, however, for individuals with reduced body reserves and at high levels of yearly demands; this testifies to the necessity of employing special measures to restore the psycho-physiological reserves of the body. The granting of preventive rest and the taking of special medical and rehabilitative steps are necessary with pronounced depletion of functional reserves.

Physicians recommend organized rest to restore the functional reserves of the body. Captain V. Zazykin is in need of that as well.

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### New Confidential Report Center To Aid in Flight Safety

93UM0420E Moscow AVIATSIYA I KOSMONAVTIKA  
in Russian No 11, Nov 92 (signed to press 2 Oct 92) p 9

[Interview with the head of the Voluntary Flight Safety Reporting Center, Candidate of Medical Sciences Lieutenant-Colonel Aleksandr Vasilyevich Chuntul under the rubric "Express-Interview": "Trust Line"]

[Text] *The independent Voluntary Flight Safety Reporting Center has been operating for several months now under the Moscow Institute of Aviation and Space*

*Medicine. For what purpose was it created? What tasks does it perform? Candidate of Medical Sciences Lieutenant-Colonel A. Chuntul, the head of the center, answers these and other questions.*

[AiK] Aleksandr Vasilyevich, what made it necessary to create the center?

[A.V. Chuntul] A few statistics to start with. Our specialists did a questionnaire. Some 280 pilots replied. It turned out that 85 percent of them had gotten into dangerous or potentially dangerous situations at least once in their flight practice. Roughly 40 percent of those cases, however, were not made known, for the most varied of objective and subjective reasons. And that means that the danger to other crews was not studied. The reasons for that situation are a topic for special discussion. A specialist understands what lies therein—the conditions for the appearance of new dangerous situations are preserved.

Our center was created so as to obtain as complete information as possible on situations that are dangerous to the pilot, pass it along promptly to all and devise scientific-methodology and psychological recommendations in good time. The center is a kind of "hotline" or "trust line." Similar voluntary-reporting systems have long existed aboard, and serve effectively for the prevention of flight accidents. More than ten crashes have been averted in the United States alone thanks to this system in recent years.

[AiK] How is your work organized?

[A.V. Chuntul] We uncover and analyze complex situations from flight practice. But we do not duplicate already existing systems for the mandatory logging of flight accidents and the preconditions to them therein. Our source of information is the voluntary and candid confidential reports of pilots on dangerous situations in flight or the ground preconditions to them. We do not make it our aim to bring those guilty of erroneous actions to liability. But every report is analyzed by experienced pilots, navigators, engineers, psychologists and other specialists. The results are passed along to the organizations concerned. A bulletin of the Voluntary Reporting Center under the title "Feedback" is put out based on those materials. It presents generalized analysis of the reports, and makes recommendations to flight personnel to get out of difficult situations.

[AiK] Who works at the center, and what funds were used to create it?

[A.V. Chuntul] Our center brings together highly qualified staffers from the Institute of Aviation and Space Medicine, candidates and doctors of sciences, physicians, pilots and engineers who are working actively in the realm of flight safety and who know what flight work is. The work is performed at personal initiative. The scientific-methodological leadership is exercised by Academician V. Ponomarenko. Our chief desire is to help the flight crews.

We receive support for our undertakings from the International Aviation Safety Fund. It provides us with literature and information on the activity of analogous foreign centers, and has furnished us with the necessary equipment for twenty-four-hour communications with callers.

[AiK] So you have a vested interest in having as many pilots as possible answer your invitation to work together?

[A.V. Chuntul] Yes, we await reports on everything that affects flight safety. Write to the address 125190 Moscow, Box Number 128, International Aviation Safety Fund, Voluntary Reports Center. Send a report or receive consultation by telephone at 155-12-74. There is a 24-hour answering machine at 212-63-42. Fax 212-20-42. Confidentiality of reports is guaranteed.

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#### **Military Engineer Training at Civilian Institutions Advocated**

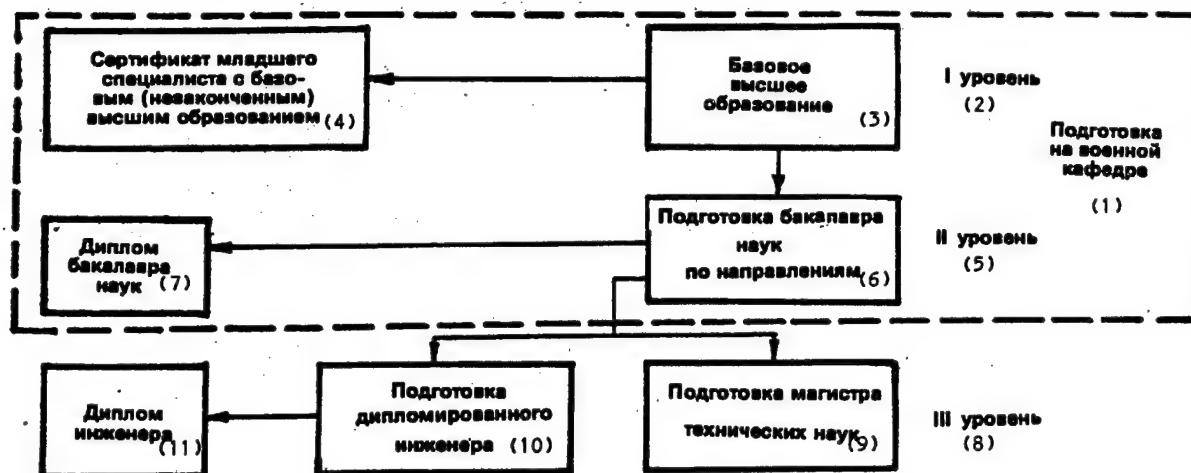
*93UM0420F Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 92 (signed to press 2 Oct 92) p 12*

[Article by Doctor of Technical Sciences Professor S. Selivanov and Candidate of Sociological Sciences Lieutenant-Colonel G. Kabakovich under the rubric "At the Military Departments of Higher Educational Institutions": "With a Regard for the Interests of the Customer"]

[Text] The training of engineers for the armed forces here, as is well known, is conducted at the educational institutions of the Ministry of Defense [MO] and at the military departments of civilian higher educational institutions. But there are typically fewer and fewer "two-year men" among the troops every year. Just what is the cause of this? It is possibly connected to some extent with the cutbacks in the army and navy and the simultaneous attempts of the Chief Directorate of Higher Educational Institutions of the MO to preserve the military schools at any price.

That path, however, is in our opinion fundamentally incorrect, since the training of an officer in the military department of a civilian educational institution costs the state four to five times less than at a higher educational institution of the MO. Perhaps, some may think, the level of training of an engineer at a civilian institution is lower? The results of comprehensive research conducted in 1988-89 among 700 young engineer officers in the Air Forces engineering service testifies to the contrary. The evaluation of their suitability as specialists was made according to the following measures: general engineering, practical and theoretical training, ability to work with subordinates, command skills and the like.

It turned out that 75 percent of the graduates of military engineering institutions and 54 percent of the civilian



## Key:

1. Training in a military department
2. level I
3. base-level higher education
4. certificate of junior specialists with base-level (incomplete) higher education
5. level II
6. training of bachelor of sciences by areas
7. bachelor of sciences degree
8. level III
9. training of master of technical sciences
10. training of degreed engineer
11. engineer's degree

ones initially conformed to the average level of qualifications requirements. That difference is explained by the lack of solid skills among the latter in working with subordinates, and the low level of knowledge of the corresponding military manuals, regulations and guiding documents. But a year later, having assimilated the conditions of army life, they improved their initial measures significantly and approached the overall level of training of the specialists in the first group.

The training of officers abroad, including reserve officers, is conducted by and large at civilian higher educational institutions. These specialists, for example, constitute 40 percent of the officer corps in the United States, while the graduates of higher military educational institutions are just 10 percent. This system of training, under terms of contract service, has been deemed economically advantageous. As for the service itself, however, we would like to cite one fact: this category of officers comprised the foundation of the contingent of American troops that took part in combat operations in the Persian Gulf.

We feel it is necessary, within the framework of the reform of military schooling that has been started in Russia, to make a transition to multilevel training of specialists for the Air Forces at the military departments

of civilian higher educational institutions (see diagram), which would make it possible for the student to complete training as desired in various stages of the system of higher education, completing later service in the ranks in accordance with the level of knowledge.

A curriculum that makes it possible to train a junior aviation specialist with base-level, incomplete higher education, for example, is envisaged for level I of the training in the military department of the Ufa Aviation Institute. The allocation of 200-250 hours of teaching time and 144 hours of general military training at training camps is proposed for that purpose. Only students who are physically fit for military service should be trained under this program, of course, which would allow them to complete the first stage of training and, if they do not wish to continue it for whatever reasons, conclude a contract with the MO and complete service at a higher rank than youth who are drafted into the service under the Law on Universal Military Obligation (if it is preserved as such).

The curriculum for the level II training at our educational institution, training in the areas of bachelor of science, allocates 716 hours for the study of subjects in

specific fields and 185 hours in the academic disciplines necessary for the professional orientation of the future specialist.

It is important to stress that higher educational institutions should receive an order from a military agency for the training of a certain quantity of engineers in this or that field with the transition of students to training at this stage. A contract is thereby concluded, as it were, between the MO on the one hand and the future officers on the other, according to which each of the parties takes on specific obligations. The students who have concluded such an agreement then complete two-year training in the military-educational field already selected (either coinciding with or close to the profile of the civilian higher educational institution), upon the completion of which they spend a month's internship in the field.

The proposed program for training a military specialist—the bachelor of sciences—thus will take about 1,500 hours all in all, and its volume will be three times that of the one existing today. The fledglings of the higher educational institutions completing such training will undoubtedly be able to compete successfully with the graduates of the military schools in practice.

In short, we should be thinking even today, during the transitional period, about how we will be training the replacements for the army of tomorrow, under completely new economic and geopolitical conditions. But we should start, one would think, with the clear-cut legal substantiation of the status of the military departments at civilian higher educational institutions, called upon to become a true foundry for the forging of officer personnel.

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### Development History of Tu-95 Bomber and Variations

93UM0420G Moscow AVIATSIYA I KOSMONAVTIKA  
in Russian No 11, Nov 92 (signed to press 2 Oct 92)  
pp 14-17

[Article by N. Kirsanov and V. Rigmant under the rubric "Domestic Aircraft": "Without Analogue"]

[Text] *The ANTK imeni A.N. Tupolev celebrated its anniversary in October—70 years since its creation—while November marked 40 years from the date of the first experimental flight of the Tu-95 strategic bomber that was developed by this KB [design bureau].*

A profound upgrading of the Tu-4 was an attempt to create an aircraft with intercontinental range in the USSR. "Aircraft 80" (its first flight was on 1 Dec 49) covered a distance of 8,000 km. The Korean war, which started soon after that, however, convincingly demonstrated the lack of prospects for the development of

piston-driven heavy-bomber aviation; jet fighters were leaving it with less and less of a chance of penetrating to protected targets.

The development of the next Soviet strategic bomber—"aircraft 85"—was halted. The creation of a bomber with a top flight speed of 900—950 km/hr, a load capacity of up to 20 tonnes, a flight range of 14,000–15,000 km without refueling and a flight altitude of 13,000–14,000 meters was proposed as a new model of such an aircraft.

A new aerodynamic configuration had to be employed and a light, as well as powerful, power plant that also had to have acceptable fuel consumption was necessary to meet such high requirements. There was virtually no other possibility of obtaining intercontinental range with all of the remaining parameters.

A basic aerodynamic configuration of the aircraft with a wing swept back 35° and a span-chord ratio of seven was selected on the basis of work at TsAGI [Central Institute of Aerohydrodynamics imeni N.Ye. Zhukovskiy] on the aerodynamics of the swept wing and the optimization of its design at the Tupolev OKB [Experimental Design Bureau].

The ideas inherent in the "aircraft 85" were further developed in the configuration of its fuselage, accommodation of the crew, armaments and equipment, but the presence of a swept-back wing made it possible to accommodate a single large bomb bay behind the torsion box in the central portion of the wing, which proved to be virtually the center of gravity of the aircraft.

The most difficult task was selecting the power plant and its configuration on the aircraft. Calculations showed that the required LTKh [performance characteristics] on which the customer was insisting, and especially the flight range, could not be obtained using TRDs [turbojet engines]. The AM-3 TRD with a thrust of 8,700 kgf and the AL-5 with a thrust of 5,000 kgf were what were realistically "at the disposal" of the Tupolev OKB at that time. V. Klimov had developed, by the end of the 1940's, an experimental version of the VK-2 TVD [turbofan engine] with a power of 4,800 ehp [effective horsepower], a unit fuel consumption of 326 g/hp-hr [grams/horsepower-hour] and a unit mass of 290 g/hp, but the refinement of that engine was still limited to bench testing.

The Tupolev OKB scrupulously studied variations of the aircraft with virtually all advanced of the engines that had been developed in the USSR—turbojets, turbojets combined with piston engines and in combination with turboprops. Various configurations for the power plant were studied. A preliminary design was executed in particular according to a plan in which six AM-3 turbojet engines were located on both sides of the fuselage, paired one over the other, and another two engines were located in the fuselage below and behind the wing. All of this

looked quite exotic, but the required performance characteristics could not be achieved even according to the first rough estimates.

The well-founded conclusion was reached as a result that four turboprops with a power of no less than 10,000 ehp apiece corresponded to the required aircraft to the greatest extent.

The new aircraft received the number "95" at the OKB. N. Bazenkov, later the chief designer of the whole numerous family of Tu-95s, was designated the supervisor of the work in this area. The chief designer for all aircraft in the Tu-95 series after his death in 1976 became N. Kirsanov.

The aircraft was constructed in two copies in accordance with the decree on the creation of the "95" that was issued on 11 Jul 51—one with TV-2 engines paired through reduction gearing (2TV-2F) and one with TV-12s. The power in takeoff mode in both versions was on the order of 12,000 ehp for each engine.

The takeoff mass of the new aircraft was determined to be 150 tonnes, and it was thus essential to resolve questions associated with structural durability with great precision. This pertained first and foremost to the swept wing, with a large span and length and with high aerodynamic properties. The mounting of four powerful engines with propellers on the wing required new design solutions to ensure its resistance to vibration. Tupolev devoted particular attention therein to observing the condition of the utmost compaction of the configuration.

A great deal of responsibility fell to the OKB of K. Zhdanov, which designed the reduction gearing and the coaxial four-bladed propellers that rotated in opposite directions. There had not yet been anything of the sort in world aviation practice. The Tu-95 thus got unique reduction gearing and propellers with a very high efficiency factor in all modes, which remain unsurpassed to the present day.

The OKB set about the production of working drawings in September of 1951; the production of the "95/1" began in the same month, and was ready a year later. The tasks in testing this aircraft were checking out as quickly as possible the correctness of the conceptual framework that had been selected for a strategic bomber with intercontinental range, as well as all of its systems and equipment under realistic conditions. The "95/1" aircraft was purely experimental, and opened the way for the "95/2" with TV-12 engines. The "95/1" went on its first experimental flight, headed by test pilot A. Perelet, on 12 Nov 52. The aircraft was in the air for 50 minutes.

Its testing continued for the whole winter and spring of the following year. There was misfortune on the seventeenth flight—the third engine caught fire. The fire could not be stopped despite all the efforts of the crew, and A. Perelet gave the order to abandon the aircraft. Only he himself and flight engineer A. Chernov remained on board, trying to save the aircraft. Navigator Kirichenko

and NISO [observation and communications] engineer Bolshakov were killed bailing out of the aircraft, while the other six crew members survived.

It was established during the course of investigation that the fire had broken out as a result of the destruction of the intermediate pinion of the reduction gearing in the third 2TV-2F engine owing to its inadequate strength, and it was not put out due to the poor effectiveness of the on-board firefighting equipment.

The crash was very hard on the whole collective of the OKB, but the second experimental aircraft was already being built and the task was to see that all of the shortcomings and omissions that had been revealed were taken into account on it, also making use of the experience in refining the first Tu-16 aircraft.

The "95/2" was built in July 1954 and was standing without engines by December of that same year; the TV-12s were being put into shape in experimental production. Every assembly was checked out with particular care at the OKBs of K. Zhdanov and N. Kuznetsov.

The "double" was taken out to the experimental airfield at the beginning of 1955, and on February 16 a crew headed by test pilot M. Nyukhtikov (co-pilot I. Sukhomlin) took the "95/2" up on its first flight. Plant testing was completed in January of the following year. Production of the aircraft at Plant No. 18 in Kuybyshev had already been launched by that time. The first two series-produced "95s" went up in October of 1955, after which the state testing was now being conducted on three aircraft.

The following results were obtained for the "95/2" aircraft: top speed of 882 km/hr, flight range with 5-tonne bomb load 15,040 km, and ceiling of 11,300 meters. The data for speed and ceiling did not meet customer requirements, and new engines were thus installed on the second series-produced aircraft (HK-12M instead of NK-12), now with a takeoff power of 15,000 ehp and lower fuel consumption. The aircraft had increased fuel reserves and takeoff mass. It reached a top speed of 905 km/hr, ceiling of 12,150 meters and range of 16,750 km in September-October 1957.

The aircraft was accepted for series production and was put out in two versions—the Tu-95 and the Tu-95M—starting in 1955. The first of them began going into service that same year. It was accepted for service in August 1957 and became the principal Soviet strategic means of restraint during the cold war, right up until the entry into service of the first land-based intercontinental ballistic missiles in the 1960's.

The series production of the Tu-95 and Tu-95M continued until 1959; several aircraft were made in a Tu-95MR strategic reconnaissance version. Two aircraft were retrofitted into passenger craft and were used for special transport. There was a pressurized compartment for 20-24 people in the bomb bays of those aircraft. They

received the designation Tu-116, and were operated by the Air Forces until the end of the 1980's.

The first series-produced Tu-95s were intended for making powerful bombing runs, including nuclear, against strategic targets located deep in the enemy rear. By the time of their creation it was felt that their combination of high speed, altitude and powerful defensive armaments would make the aircraft virtually invulnerable to the PVO [air defenses] of the time.

The cannon armaments (six AM-23) made it possible to accomplish virtually complete all-round protection against enemy fighters. The tail mount was equipped with the Argon radar firing sight.

The bomb load of the Tu-95 ranged from 5 to 15 tonnes depending on the range of the flight. The maximum caliber of bombs on internal racks was 9 tonnes.

The Tu-95 equipment included the most modern systems of the times, making it possible to perform flights in bad weather conditions.

The crew on the first Tu-95 aircraft consisted of eight men—two pilots, a navigator, a flight engineer, a navigator/weapons officer, a radar operator/gunner (in the forward turret) and two gunners in the tail compartment. The lack of ejection seats, as opposed to other jet bombers of the times, was a specific feature of the rescue system on the Tu-95.

In case of emergency, the crew bailed out of the forward flight deck through the open hatch of the nose wheel strut using a movable transporter, while the rear gunners bailed out through a bottom hatch.

The Tu-95 suffered a crash in March of 1957. The failure of one engine should not have led to a crash situation, but the system for switching the propellers to feathered position was not actuated on that flight. The NK-12MV engine, with automatic and manual feathering, went into series production very quickly starting that same year.

The strengthened air defenses of the likely adversary required improvements in performance characteristics by the aircraft's developers. The decision had been made as early as 1952 to build a high-altitude strategic bomber with a ceiling above the target of 17,000 meters and a range of 9,000-10,000 km at that altitude, with a bomb load of 5 tonnes and a speed of 800-850 km/hr. The installation of the new NK-16 engine, for higher altitude and more power, was planned for it. The aircraft—it received the designation Tu-96—had somewhat larger dimensions and a new fuselage, nose compartment and design of the center section. Its factory testing began in 1956. It had already become clear by that time, however, that the higher flight altitude would not save the bomber from attacks by supersonic interceptors and SAMs [surface-to-air missiles]. Work on the Tu-96 was curtailed.

The creation of airborne missile systems, utilizing the long flight range of the launch platforms and the invulnerability of guided winged missiles launched from a

carrying aircraft several hundred or thousand kilometers from the target, became the chief direction for increasing the effectiveness of the aviation strike forces in the middle and second half of the 1950's. This combined version was intended to increase the survivability of the strike system.

The aircraft-missile system, which received the name Tu-95K-20, began to be developed in March of 1955. The aircraft launch platform was refined—a new nose portion was designed, where the radar for target acquisition and guidance of the winged missile to the target was installed. The OKB of A. Mikoyan created the Kh-20 guided winged missile for it, with a range of 350 km and a flight speed of Mach 2. The Kh-20 was in the bomb bay on a special retainer, which lifted the bomb up before the flight and lowered it before launch.

A prototype of the launch platform—the Tu-95K—went up on the first day of 1956. Refinement work on the system began. The specialists at the OKB refitted a MiG-19 (the SM-20 aircraft) to test the Kh-20 systems, on which the guidance system and system for hanging and launching it from the launch platform were checked out in a manned version.

The testing and refinement of the system was drawn out in view of the novelty of the matter, and the Tu-95K-20 officially entered service only in the fall of 1959.

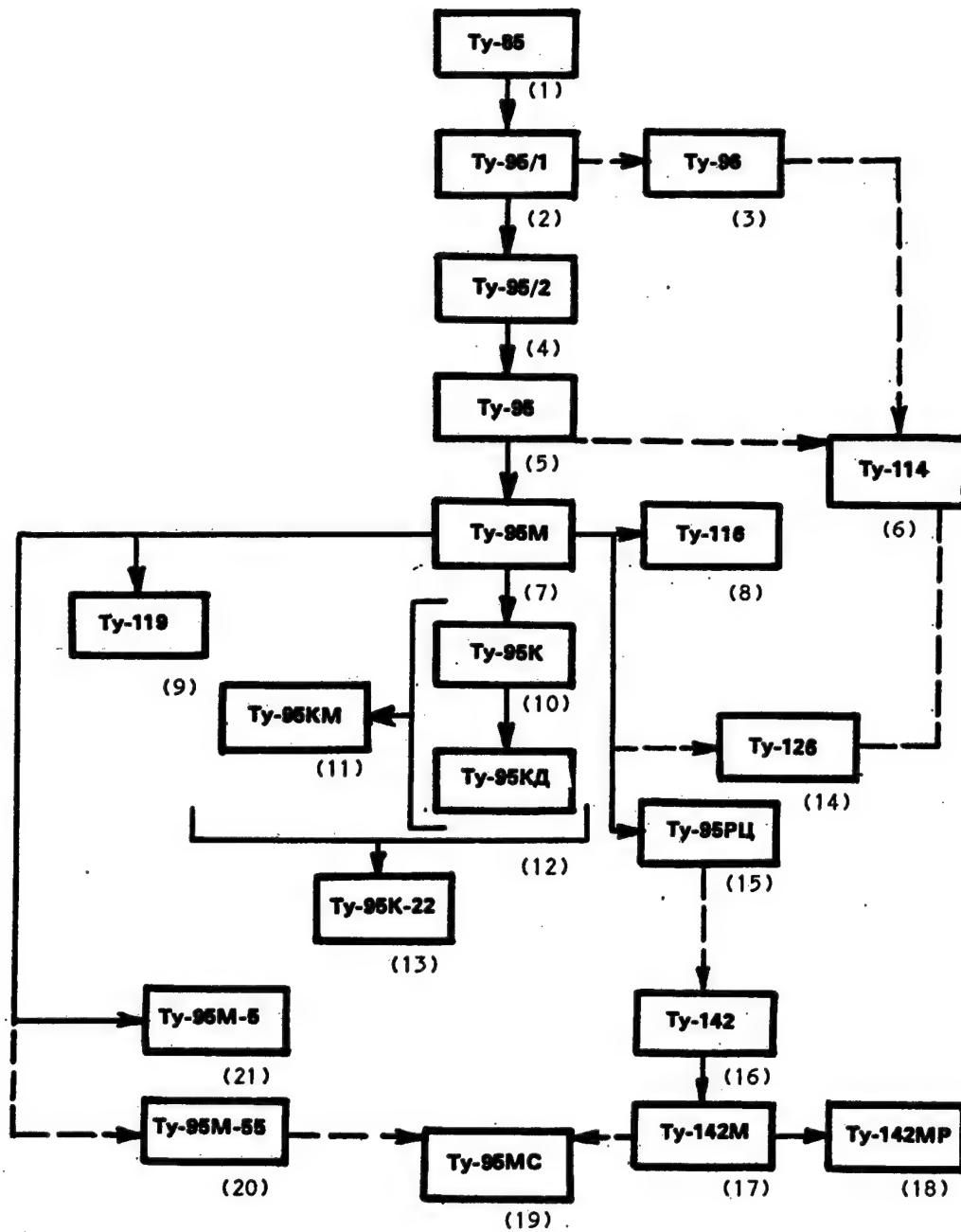
The aerodynamics of the Tu-95 worsened as a result of the refinements, and the flight range consequently decreased. The situation could be saved only through aerial refueling. The Tupolev OKB was entrusted with developing a "probe and drogue" aerial-refueling system for the Tu-95K aircraft in May of 1960. The first Tu-95K was fitted with the system and received the designation Tu-95KD a year later. Both versions, the K and the KD, were in series production until 1965, thanks to which the combat capabilities of domestic strategic aviation were enhanced considerably.

An upgrading of the electronic and navigational equipment was performed on some of the K-series aircraft in the 1960's. That aircraft received the designation Tu-95KM.

The decision was made at the beginning of the next decade to retrofit the Tu-95K and Tu-95KD into launch platforms for air-to-surface missiles analogous to those employed on the Tu-22 and Tu-22M aircraft. The new system—the Tu-95K-22—included one or two missiles mounted on pylons under the wing or in the bomb bay.

An experimental Tu-95K-22 created on the basis of a series-produced Tu-95K made its first flight in October of 1975. The refinement of the fleet of Tu-95K aircraft into Tu-95K-22s began after the completion of all testing at the end of the 1970s. The aircraft were in operation in their new capacity starting at the beginning of the 1980's.

The USSR Navy, as is well-known, began gaining access to ocean spaces at the beginning and in the middle of the



## Key:

1. Tu-85
2. Tu-95/1
3. Tu-96
4. Tu-95/2
5. Tu-95
6. Tu-114
7. Tu-95M
8. Tu-116
9. Tu-119
10. Tu-95K
11. Tu-95KM

12. Tu-95KD
13. Tu-95K-22
14. Tu-126
15. Tu-95RTs
16. Tu-142
17. Tu-142M
18. Tu-142MR
19. Tu-95MS
20. Tu-95M-55
21. Tu-95M-5

1960's. Its underwater and surface forces required a means of long-range reconnaissance and target designation. The Tu-95RTs had gone into testing as early as 1962. A whole complex set of radar and electronics systems for the new aircraft was refined and brought up to par over two years, and it began entering service with naval units in 1964.

The Tu-126 long-range radar-detection aircraft fitted with the Liana radar system occupies a special place among the versions of the Tu-95. Work on it was undertaken as early as 1960. The first experimental prototype was ready in two years. Another eight Tu-126s came out in 1965-67. All nine aircraft were in service until the beginning of the 1980's, when they were replaced by the more advanced A-50.

One of the most important components of the American nuclear "triad" since the beginning of the 1960's has been the combination of nuclear submarines armed with sea-launched ballistic missiles. Work was started in the USSR in 1963 to create a long-range ASW strike system based on the Tu-95, able to detect and destroy submarines both on the surface and underwater, in order to combat them. The first flight of the experimental Tu-142 was made in the summer of 1968. It differed from the Tu-95 in the complement of equipment, the new wing design and the reduced complement of cannon armaments. The Tu-142 initially had an original undercarriage for the main landing gear with six wheels, which provided for the possible utilization of unfinished runways. Tu-142 aircraft have been in service with the naval forces since December of 1972.

The combat capabilities of missile-launching nuclear submarines increased markedly in the 1970's, which required an upgrading of the means of ASW that included the antisubmarine aviation systems.

The OKB imeni A.N. Tupolev started working in 1972 on a modernization of the Tu-142 under the overall supervision of General Designer A.A. Tupolev. In the course of that work they created the Tu-142M, on which equipment for detecting quiet-running submarines, a more precise system for inertial navigation, a new system for automated radio communications and a Ladoga magnetometer were installed, while the forward flight deck was completely changed. The first flight on a Tu-142M was made by test pilot I. Vedernikov on 4 November 1975. This aircraft has been operating successfully in the units since 1980. The Tu-142MR communications-relay aircraft, used in the interests of the submarine fleet, was subsequently developed on the basis of the Tu-142M.

Work in the United States to modernize strategic aviation strike systems based on the B-52 and arm them with cruise missiles elicited a reciprocal "reaction" from the Soviets. The start of work began on refitting the fleet of Tu-95s for new missile armaments can be traced to the beginning of the 1970's, when the Tu-95M-5 (the Tu-95K-26 system) armed with two of the KSR-5 missiles

used on the Tu-16K-26 was produced experimentally. This direction, however, was not further developed.

A series-produced Tu-95M was also experimentally refitted into a launch platform for air-launched cruise missiles—the Tu-95M-55—in 1976. It completed factory testing in 1978, but the decision to make over the aircraft fleet was not made.

Work was under way at the same time on the creation of a strategic bomber based on the Tu-142M to carry cruise missiles. The new aircraft, which received the designation Tu-95MS, made its first flight in September of 1979, entered service at the beginning of the 1980's and currently constitutes the foundation of strategic aviation for the CIS armed forces.

One of the best-known versions of the Tu-95 aircraft was its passenger version, the Tu-114. Work at the Tupolev OKB on that aircraft started in 1955. The first experimental prototype was taken up by test pilot A. Yakimov on 10 Nov 57. State testing was completed in July of 1960, and operational testing in March of the following year.

The first flight of the Tu-114 with passengers on board, flying from Moscow to Khabarovsk, took place on 24 Apr 1961. There were 31 Tu-114 aircraft in all built at the Kuybyshev Aviation Plant, and they operated successfully on domestic and international routes for 15 years. More than 6 million passengers were transported over that time. The aircraft was produced in 170- and 200-passenger configurations. A variation for flights to Cuba was made starting in 1962—the number of seats was reduced to 120 due to the necessity of increasing fuel reserves. Regular flights to Havana with one intermediate stop began in January 1963.

The Tu-114 set 32 world records recorded by the FAI [Fédération Aéronautique Internationale]. The aircraft was awarded the Grand Prix at the Brussels International Exhibition in 1958, and A.N. Tupolev was awarded the Grand Gold Medal of the FAI.

Various flying laboratories were also created on which advanced engines, equipment and aircraft systems were tried out. The Tu-119 aircraft, built on the basis of the Tu-95M and performing the role of flying laboratory for an aircraft nuclear power plant, was tested at the beginning of the 1960's. There were also a host of designs for aircraft to be used as launch platforms for various types of manned and unmanned craft that were not implemented.

The Tu-95, the sole aircraft in the world in this class with turbofan engines, has traversed a glorious and complex path from the moment of its birth to the present day, and is without analogue in design either here or abroad.

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**Technical Data on Il-78 Tanker Aircraft**

93UM0420H Moscow AVIATSIYA I KOSMONAVTIKA  
in Russian No 11, Nov 92 (signed to press 2 Oct 92)  
pp 26-27

[Article by V. Ilin under the rubric "Information for Reflection": "Tanker Aircraft"]

[Excerpt] *The constant improvement of strike aviation has required the corresponding development of the fleet of tanker aircraft as well. The increasing cost of aviation hardware, at the same time, has caused a rejection of narrowly specialized "flying" tankers and provided an impetus for the development of tanker aircraft based on existing series-produced heavy-load transport and passenger aircraft.*

**Il-78**

**Crew.** Seven.

**Dimensions.** Wingspan 50.50 meters, area 300 m<sup>2</sup>; length of aircraft 46.59 meters, height 14.76 meters.

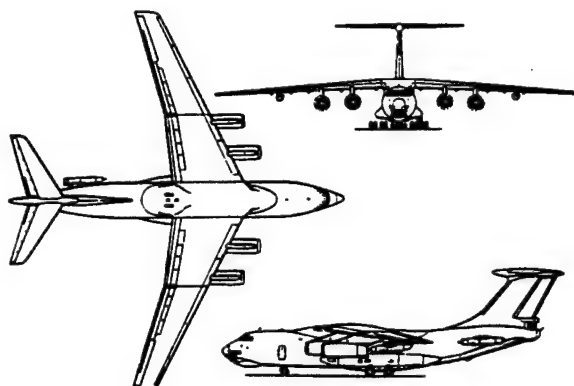
**Mass.** Maximum takeoff mass 190,000 kg, empty takeoff mass 98,000, maximum landing mass 151,500, fuel in wing tanks 90,000 kg, fuel in fuselage tanks 28,000 kg.

**Flight characteristics.** Cruising speed 750-800 km/hr [kilometers/hour]; range of speeds in refueling 400-600 km/hr; maximum range with payload of 20,000 kg-7,300 km, with payload of 50,000 kg-3,650 km; altitude of cruising flight—up to 12,000 meters; range of altitudes in refueling 2,000-9,000 meters; takeoff run 850 meters, landing runout 450 meters; maximum operational G-forces with payload of 100,000 kg-2.9, with flight mass of 180,000 kg-2.0

**Engines.** D-30KP-2 (4 x 12,000 kgf) turbojet bypass engines.

**Equipment.** The fuselage has two removable tanks holding up to 14,000 kg of fuel each. Its tail section to the left and under the wing has UPAZ-1A external standardized refueling assemblies, providing for refueling using the "drogue and probe" method (this equipment can be installed on other aircraft as well, and on the Su-24 bomber in particular). The refueling of one aircraft in the heavy-bomber class with fuselage refueling gear or the simultaneous refueling of two MiG-31 or Su-24 aircraft with the aid of wing refueling gear is possible.

The aircraft has a pressurized freight compartment (24.50 x 3.45 x 3.35 meters) with a lowering freight



ramp, and when the fuselage fuel tanks are removed it may be used, like the KC-10A, as a conventional military transport.

There is also navigational and weather radar, an on-board computer and electronic-warfare gear.

**Armaments.** There is a rear cannon mount analogous to that on the Tu-95MS bomber (two GSh-23 23mm cannons with optical and radar sights).

**Status.** In service and in series production. The principal tanker aircraft of CIS aviation.

**Additional information.** Created on the basis of the Il-76 military transport aircraft, which made its first flight in 1971 and has been in series production since 1975. The Il-78 began entering service with line units in 1987. It is intended for the refueling of both heavy bombers and aircraft of the MiG-31, Su-24 and Su-27 types, among others. [Passage omitted]

[Information on KC-10A Extender omitted.]

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**Continued Listings of Cosmonaut Crews**

93UM0420I Moscow AVIATSIYA I KOSMONAVTIKA  
in Russian No 11, Nov 92 (signed to press 2 Oct 92)  
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[Material prepared by I. Marinin and S. Shamsutdinov under the rubric: "By Reader Request"]

[Text] *We continue to acquaint the readers with the recruitments to the cosmonaut corps of various organizations and agencies. The material was prepared by Videokosmos TO Information Department staffers I. Marinin and S. Shamsutdinov.*

No.	Name	Date and place of birth	Education	When left Corps	Reason for leaving and current position
1	2	3	4	5	6

Recruitments to Cosmonaut-Test Pilot Corps of the Sector Cosmonaut-Test Pilot Training Complex (OKPKI) of the LII [Flight Research Institute] imeni M.M. Gromov

First Recruitment (30 Jun 80)

1	Igor Petrovich Volk	12 Apr 37, city of Zmiyev, Kharkov Oblast	Kirovograd VAUL [Military Aviation School for Pilots] in 1956, MAP [Ministry of the Aviation Industry] Test-Pilot School (ShLI) in 1965, MAI [Moscow Aviation Institute] in 1969	—	chief of OKPKI. Cosmonaut-test pilot.
2	Oleg Grigoryevich Kononenko	16 Aug 38, town of Samarskoye, Rostov Oblast	MAP ShLI in 1966, MAI in 1975	1980	died in air crash 3 Sep 80
3	Anatoliy Semenovich Levchenko	21 May 41, city of Krasnokutsk, Kharkov Oblast	Chernigov VVAUL [Higher Military Aviation School for Pilots] in 1964, MAP ShLI in 1971	1988	died 6 Aug 88
4	Rimantas Antanas-Antano Stankavichyus	26 Jul 44, Marijampol, Lithuania	Chernigov VVAUL in 1966, MAP ShLI in 1975	1990	died in air crash 9 Sep 90
5	Aleksandr Vladimirovich Shchukin	19 Jan 46, Vienna, Austria	Kachinsk VVAUL in 1970, MAP ShLI in 1977	1988	died in air crash 18 Aug 88

Second Recruitment (9 Mar 83)

1	Ural Nazibovich Sultanov	18 Nov 40, town of Nikiforovo, Alshevskiy Rayon, Bashkortostan	Kharkov VVAUL in 1971, MAP ShLI in 1978, MAI in 1981	—	cosmonaut-test pilot at OKPKI
2	Magomed Omarovich Tolboyev	20 Jan 51, town of Sogratl, Gunibskiy Rayon, Dagestan	Yeysk VVAUL in 1973, MAP ShLI in 1981, MAI in 1984	—	cosmonaut-test pilot at OKPKI

Third Recruitment (15 Feb 84)

1	Viktor Vasilyevich Zabolotskiy	19 Apr 46, Moscow	MAP ShLI in 1975, Civil Aviation Academy in 1981	—	cosmonaut-test pilot at OKPKI
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Fourth Recruitment (7 Sep 85)

1	Sergey Nikolayevich Tresvyatskiy	6 May 54, city of Nizhneudinsk, Irkutsk Oblast	Kachinsk VVAUL in 1975, MAP ShLI in 1983, MAI in 1985	—	cosmonaut-test pilot at OKPKI
2	Yuriy Petrovich Sheffer	30 Jun 47, Chelyabinsk	Kachinsk VVAUL in 1970, MAP ShLI in 1977, MAI in 1980	—	cosmonaut-test pilot at OKPKI

Fifth Recruitment (25 Jan 89)

1	Yuriy Viktorovich Prikhodko	15 Nov 53, city of Dushanbe, Tajikistan	Kachinsk VVAUL in 1975, MAI in 1989	—	cosmonaut-test pilot at OKPKI
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Recruitments to Cosmonaut-Test Pilot Corps of RF MZ [Russian Federation Ministry of Health] IMBP [Institute of Medical-Biological Problems]

First Recruitment (May 1964)—for flight on Voskhod craft

1	Boris Borisovich Yegorov	26 Nov 37, Moscow	1st Moscow Medical Institute imeni I.M. Sechenov in 1961	1982	director of scientific-production center for medical biotechnology of RF MZ
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No.	Name	Date and place of birth	Education	When left Corps	Reason for leaving and current position
<b>Second Recruitment (1965)*—for flight on Voskhod-5 craft</b>					
1	Yevgeniy Aleksandrovich Ilin	17 Aug 37, city of Tula	Military Medical Academy imeni S.M. Kirov in 1961	1966	ceased training due to cancellation of flight. Deputy director of IMBP
2	Aleksandr Alekseyevich Kiselev	13 Jun 35, Moscow	1st Moscow Medical Institute imeni I.M. Sechenov in 1959	1966	ceased training due to cancellation of flight. General director of Soyuzmedinform NPO [Scientific-Production Association]
3	Yuriy Aleksandrovich Senkevich	4 Mar 37, city of Gaybalkan, Mongolia	Military Medical Academy imeni S.M. Kirov in 1960	1973	in reserves since 1966. Head of IMBP department. Moderator of television program "Travelers' Club"
<b>Third Recruitment (22 Mar 72)</b>					
1	Georgiy Vladimirovich Machinskiy	11 Oct 37, Moscow	1st Moscow Medical Institute imeni I.M. Sechenov in 1965	1974	dropped for health reasons. Senior scientific associate at IMBP
2	Valeriy Vladimirovich Polyakov	27 Apr 42, city of Tula	1st Moscow Medical Institute imeni I.M. Sechenov in 1965	—	deputy director of IMBP. Cosmonaut-test pilot at IMBP
3	Lev Nikolayevich Smirenniy	25 Oct 32, city of Ivanovo-Voznesensk, Ivanovsk Oblast	Moscow Engineering-Physics Institute in 1956	1986	dropped for health reasons. Head of laboratory at IMBP
<b>Fourth Recruitment (1 Dec 78)</b>					
1	German Semenovich Arzamazov	9 Mar 46, village of Shubino, Sharaganskiy Rayon, Nizhegorod Oblast	1st Moscow Medical Institute imeni I.M. Sechenov in 1974	—	cosmonaut-test pilot at IMBP
2	Aleksandr Viktorovich Borodin	3 Mar 53, city of Volgograd	1st Moscow Medical Institute imeni I.M. Sechenov in 1976	—	cosmonaut-test pilot at IMBP
3	Mikhail Georgiyevich Potapov	20 Oct 52, village of Babeyevo, Noginskiy Rayon, Moscow Oblast	1st Moscow Medical Institute imeni I.M. Sechenov in 1976	1985	dropped for health reasons. Laboratory head at IMBP
<b>Fifth Recruitment (30 Jul 80)</b>					
1	Galina Vasilyevna Amelkina	22 May 54	Moscow Medical Stomatological Institute imeni N.A. Semashko in 1978	1982	dropped for health reasons. Assistant at the Moscow Medical Stomatological Institute
2	Yelena Ivanovna Dobrokvashina	8 Oct 47, Moscow	1st Moscow Medical Institute imeni I.M. Sechenov in 1972	—	cosmonaut-test pilot at IMBP. Division head at IMBP
3	Tamara Sergeyevna Zakharova	22 Apr 52, Moscow	1st Moscow Medical Institute imeni I.M. Sechenov in 1976	—	cosmonaut-test pilot at IMBP

No.	Name	Date and place of birth	Education	When left Corps	Reason for leaving and current position
4	Olga Nikolayevna Klyushnikova	14 Oct 53, Moscow	2d Moscow GMI imeni N.I. Pirogov in 1978	—	scientific associate at IMBP. Completed OKP in 1979-80, but was not enrolled in the corps on 30 Jul 80. In reserves until 1986
5	Larisa Grigoryevna Pozharskaya	15 Mar 47, city of Zaraysk, Moscow Oblast	Moscow Medical Stomatological Institute imeni N.A. Semashko in 1972	—	cosmonaut-test pilot at IMBP was soon curtailed and the training ceased.

\* Actually only completed the medical selection for TsVNIAG in 1965. They were present at the IMBP base at the beginning of 1966, but the program was soon curtailed and the training ceased.

(To be continued)

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in Russian No 11, Nov 92 (signed to press 2 Oct 92)

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### Publication Data

93UM0420K Moscow AVIATSIYA I KOSMONAVTIKA  
in Russian No 11, Nov 92 (signed to press 2 Oct 92)

[Text]

English title: AVIATION AND COSMONAUTICS  
Russian title: AVIATSIYA I KOSMONAVTIKA  
Editor: V.V. Anuchin  
Publishing house: Voenizdat  
Date of publication: November 1992  
Signed to press: 2 Oct 92  
COPYRIGHT: "Aviatsiya i kosmonavtika," 1992.

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